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ABSTRACT

Junior high school aged academically precocious youths participated in two experiments. In Experiment 1, Ss were required to closely process a spatially organized map or a list map prior to hearing a related prose passage. In Experiment 2, a spatially organized map was presented either before or after Ss listened to prose passages. Results indicated that although occurrence of presentation of the spatially organized map made no difference in amounts of information recalled, spatially organized maps facilitated recall of related prose material significantly more than list maps. Results also indicated that Ss in spatially organized conditions and Ss in prior presentation conditions were able to reconstruct accurately map features significantly better than the other conditions. In addition, Ss in spatially organized and prior presentation conditions appeared to benefit from the spatial organization rather than individual feature imagery, while Ss in list and posterior presentation conditions appeared to rely upon individual feature imagery. (Author/CL)

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Maps as Schema for Gifted Learners[1]

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Abstract

Junior high school aged academically precocious youths participated in two experiments. In Experiment 1, learners were required to closely process a spatially organized map or a list map prior to hearing a related prose passage. In Experiment 2, a spatially organized map was presented either before or after learners listened to prose passages. Results indicated that although occurrence of presentation of the spatially organized map made no difference in amounts of information recalled, spatially organized maps facilitated recall of related prose material significantly more than list maps. Results also indicated that learners who were in spatially organized conditions and learners who were in prior presentation conditions were able to reconstruct accurately map features significantly better than the other conditions. In addition, learners in spatially organized and prior presentation conditions appeared to benefit from the spatial organization, rather than individual feature imagery, while learners in list and posterior presentation conditions appeared to rely upon individual feature imagery.

Maps as Schema for Gifted Learners

Maps are a special form of illustrative aid and provide learners with a spatial framework for organizing instructional content. Dean and Kulhavy (1981) conducted two experiments to study the effects of providing a map-like device as an organizational tool for learning prose passages. Results indicated that learners who were required to construct a map that represented the passage they read performed better on all measures of immediate recall. Schwartz and Kulhavy (1981) reported that use of a map increased the level of general recall and enhanced memory for information specifically related to features on the map. In this study, the investigators manipulated the type of map presentation among subjects to form three treatment groups: a spatially organized map, a randomized map, and a control map. They concluded that exposure to a spatially related map facilitated recall of associated prose passages. Shaha (1981) also found similar results. In this investigation learners, who were required to learn spatial relations either spatially, or as an image, recalled more information than learners who were required to learn descriptors.

Kulhavy, Schwartz, and Shaha (in press) have suggested that maps seem to affect memory for prose by forming cognitive representations which a learner is able to use as a vehicle for storing related semantic

material. These investigators have called this process conjoint retention and defined it as the process in which the dual code of spatial and semantic information is remembered better than either representation by itself.

In the studies that follow, we were concerned with the effects of maps with junior high school age academically precocious, or "gifted" students. Recent research has indicated that although academically precocious youths outperform their age peers on learning tasks, they nontheless learn in a manner qualitatively similar. In addition, they have been seen to benefit from spontaneously produced, or externally imposed learning strategies (Levin, Dretzke, McCormick, Scruggs, McGivern & Mastropieri, Note 1; Scruggs, 1982).

In Experiment I we examined the effects of exposure to maps made under either a spatially organized or a list condition. Experiment II was intended to determine whether a prior or posterior presentation of a spatially organized map facilitated recall of related information. In both studies we examined the relation between correct feature items on recall and reported imagery of those items, as well as performance on all items and on a map reconstruction task.

Experiment 1

Method

Design and subjects. The type of map presentation was varied to form two treatment groups with both category of question and treatment condition manipulated within subjects. The design was a two presentation (spatially organized map vs. list map) by two question (feature vs. nonfeature) factorial design, with repeated measures on the recall variable.

Twenty four seventh and eighth grade students enrolled in classes for academically precocious youth voluntarily participated in this study. All students had previously scored in the top stanine on the California Achievement Test; in addition, all had attained a score equivalent to or higher than the 32nd percentile of college bound high school seniors on either the Scholastic Achievement Test (SAT), either verbal (SAT-V) or mathematics (SAT-M) section, or the Test of Standard Written English (TSWE) (Educational Testing Service, 1981). Participants in this investigation ranged in age from 12 years 7 months to 15 years 1 month, with a mean age of 13 years 10 months and a standard deviation of 9 months. SAT-V scores ranged from 320 to 610 with a mean of 480 and a standard deviation of 76. SAT-M scores ranged from 280 to 770 with a mean score of 490 and a standard deviation of 137. TSWE scores ranged from 39 to

60 with a mean of 51 and a standard deviation of 7.4. Twelve participants were boys and 12 were girls.

Materials

Map. The map used in this study was an 11 x 14 inch two-dimensional graphic representation of an imaginary island named "McHayden." The island is essentially triangular in shape, has a river running from the upper right side to the lower left side, and is surrounded on the Northeast and Southeast by reef outlines. Each map has seventeen features which are represented by a figure and a one-word label. Feature names are:mountain, fields, harbor, plantation, swamp, corrals, airfield, reef, palms, desert, graveyard, lighthouse, river, jungle, village, and beach. The spatially organized map presents each feature on the map in an organized location on the map, while the randomized map presents the outline of the island with features and labels listed randomly on the left side. Amounts and types of information provided to both conditions are identical.

Test passage. The 00 word passage was written by the authors. The passage was audiotaped and read in a female voice at a speed of approximately 100 words per minute. The passage is titled "McHayden" and describes the history of a fictitious tropical island. Specific information centering on a map feature and an event associated directly to each

feature is mentioned once in the passage. The passage was assessed using the Fry Readability Formula (Fry, 1972) to be within the 9th grade reading level. Following is an example of several sentences from the passage (the feature name was not emphasized in the experimental material): "Many superstitious practices are carried out today on McHayden. For instance, each year during the spring season, the natives cut mangrove roots from the swamp and carve elaborate representations of animals on them."

Recall questions. A cued recall test consisting of complet items was constructed. Seventeen items refer to information associated with a feature, and 17 items refer to text material having no direct connection with a feature. All questions could be answered in one or two words. Items pertaining to features required the feature itself as the correct response. For example:

Feature Item: Where were the fruit trees growing?

Nonfeature Item: What happened on McHayden about a century ago? The thirty-four recall questions were assigned random positions on the test.

Map reconstruction. A map reconstruction task sheet was designed to measure the number of features th students could accurately locate on a map. Map reconstruction task sheets were identical in size to the map stimuli studied. The outline of the island was on a

sheet, but the remainder of the features were omitted.

Imagery rating scale. A rating scale was designed to measure the amount of imagery used by students while they completed the map reconstruction task. The rating required students to respond to the question, "How well did you see the image of the picture in your mind while you were answering the following question: 1) not at all, 2) some, or 3) very clearly."

Procedure

Upon entering a quiet room, students were randomly assigned treatments in small groups. Students in the spatially organized map group were seen in two groups of four students and two groups of two students, while students in the list map group were seen in two groups of four students, one group of three students, and one group of one student. The examiner informed students that they were about to study a map and then listen to a story. Students were told that the learning of the map would aid them greatly in understanding the passage to follow. Students in the spatially organized (map) condition were shown as a group a spatially organized map, while students in the list condition were shown as a group a list map. Each group received a three-minute lesson on the features of the map, in which subjects were required to repeat after the

examiners the names of each feature. Students then listened to a tape recording of the passage two consecutive times. Students were then required to answer constructive response questions. No time limit was imposed on the task. Following this students were asked to reconstruct the map. Finally students were asked to complete the imagery rating scale.

Results

The recall data were entered into a 2 organization by 2 recall measure ANOVA and yielded significant effects for organization $F(1,47) = 8.30$, $p < .01$. The spatially organized group recalled significantly more feature related information ($\bar{X} = 15.33$, SD = 1.55) and nonfeature information ($\bar{X} = 12.75$, SD = 2.59) than the list group (feature, $\bar{X} = 8.75$, SD 3.93; nonfeature $\bar{X} = 9.83$, SD 3.73).

Figure 1 displays graphically the organization X recall interaction. The spatially organized group reconstructed significantly more features than the randomized group ($p < .05$).

To investigate the effects of performance related to feature imagery, proportion correct of feature items was computed for each group as a function of imagery condition, collapsed into two categories, (1 = no imagery, and 2, 3 = imagery reported). Proportions correct by

group and imagery condition are given in Figure 2.

Insert Figure 1 and Figure 2 about here

Discussion

The main effect and interaction seen in the recall variables replicates the findings of Schwartz and Kulhavy (1981) on academically precocious youths. Students in the spatial condition performed better than those in the list condition on recall of feature items, non-feature items and map reconstruction scored for number of features recalled. It appears that the spatially organized map served as a framework for organizing the related prose passage, since students in the map condition outperformed those in the list condition in map reconstruction.

Students in the map condition performed similarly whether or not they reported images of the feature (93.0% vs 89.3% respectively). In contrast, students in the list condition scored higher on items for which they reported images (35.6% vs 67.9%). This differential effect suggests that the spatial organization itself facilitated learning in the map condition. In contrast, students who were not provided a spatially organized map relied upon imagery of the features to enhance their recall. Imagery apparently facilitated learning somewhat, but not to the extent found in the group with the spatially organized map.

Experiment 2

In Experiment 1, we reported that academically precocious students used spatially organized maps as a cognitive link to feature-related information. This link apparently served to facilitate recall, as well as performance on a map-reconstruction task. In Experiment 2, we attempted to determine whether a prior or posterior presentation of a spatially organized map differentially affected performance on item recall or map reconstruction, or for different imagery conditions.

Method

Design and subjects. The occurrence of map presentation was varied to form two treatment groups with both prior and posterior presentation of map manipulated between subjects. The design was a two occurrence (map prior vs. map posterior) by two question (feature vs. nonfeature) factorial design with repeated measures on the recall variable.

Eighteen seventh and eighth grade academically precocious students enrolled in the same program as those in Experiment 1 voluntarily participated in this study. The nine girls and nine boys ranged in age from 12 years 0 months to 15 years one month with a mean age of 13 years 10 months and a standard deviation of 8 months. SAT-V scores ranged from 340 to 620 with a mean of 450 and a standard deviation of 136. SAT-M scores ranged from 280 to 710 with a mean of 480 and a standard deviation of 100,

scores ranged from 36 to 60 with a mean of 49 and a standard deviation of 7.6.

Materials

The spatially organized map used in Experiment 1 was reduced to an 8 1/2 x 11 inch size and used for both conditions. The test passage, recall questions, and imagery scale were identical to those used in Experiment 1.

Procedure

All procedures were the same as those in Experiment 1, except that each student received his/her own map, and the prior condition received the map before hearing the passage, while the posterior condition received the map immediately after hearing the passage. Both groups were allowed to study the map for three minutes, during which time a lesson on the map features was conducted in which subjects were required to repeat the map feature names after the examiner. The small groups in which students participated were the following: prior presentation: two groups of three, one group of two, and one group of one; posterior presentation: one group of three, two groups of two, and two groups of one.

Results

The data were entered into a 2 (occurrence) x 2 (recall measure) repeated measures ANOVA which yielded nonsignificant differences for occurrence of map presentation and feature versus nonfeature, $F(1, 17) = 3.189$, $p > .10$, $F(1, 18) = 2.32$, $p > .20$. On the map reconstruction task, however, when features were scored for correct location, significant differences were found, $t(16) = 2.47$, $p < .05$. Correct feature location was scored using a transparent overlay of the McHayden map. The overlay was placed on the students' maps, and features were scored correct if any part of the student produced feature touched the original representation. Learners who received the map for three minutes prior to listening to the passage accurately relocated significantly more features than learners who viewed the map for three minutes after listening to the passage ($\bar{X} = 12.4$ vs 9.1, respectively, $t(16) = 2.47$, $p < .05$).

Relations between reported imaging of features and performance were computed as in Experiment 1. Proportion of feature items recalled in the prior condition were similar regardless of whether imagery was reported or was not reported (83% vs 88%, respectively). In the posterior condition, however, proportion correct of items for which imagery was reported far exceeded proportion correct of items for which imagery was not reported (79% vs 57%). This data is depicted graphically in Figure 3.

Insert Figure 3 about here

Discussion

Subjects in the prior and posterior conditions did not differ in the amount of feature and nonfeature information recalled. Under either a three minute prior or three minute posterior presentation, a spatially organized map did not increase overall performance on feature items. Qualitative differences, however, were observed in performance as a function of reported imagery. Figure 3 indicates that memory of the feature image did not improve performance for the prior presentation group, while feature imaging did improve performance for the posterior presentation group. This indicates that in the prior presentation group the map provided a spatial schema upon which feature related information was encoded. The individual feature imagery was not necessary because subjects relied upon a whole spatial reference. Further support of this is found in that the prior presentation group reconstructed significantly more features on the map reconstruction task. In the posterior presentation group, students did not have a prior schema, and therefore relied more upon imagery of the individual features.

General Discussion

Spatially organized maps were seen to facilitate recall of related information for academically precocious youths, although the amount of time of map presentation may influence map effectiveness. Both experiments supported the notion that maps can serve to provide a spatial framework upon which learners can encode related prose information. Maps presented either after presentation of prose material or in a list format apparently do not have the same effect upon learners.

Both experiments also suggest that when learners have a prior spatial framework they do not rely on imaging individual features. When learners receive maps in a list form or after hearing a passage, use of feature imagery apparently facilitated prose recall.

The above results support the conjoint retention hypothesis of Schwartz and Kulhavy (1981), in that information was apparently encoded both spatially and propositionally. That is, spatial organization had a separate effect on recall, apparently enhancing recall of the verbal information.

Our findings further support existing research which suggests that academically precocious youths learn in a manner qualitatively similar to more typical learners. This evidence is in contrast to a view currently held by many educators that "gifted" students learn in a manner

qualitatively different from their more typical age peers (cf. Robinson, 1977). This view of qualitative differences in learning appears to lack strong empirical support; our own findings indicate that academically precocious youth, similar to the more typical population, encode information both spatially and propositionally, and that the presentation of spatial information facilitates prose learning.

Reference Note

1. Levin, J. R., Dretzke, B. J., McCormick, C. G., Scruggs, T. E., McGivern, J. E., & Mastropieri, M. A. Learning mnemonically: An analysis of the presidential process. Manuscript submitted for publication, 1982.

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Figure 1

Organization X Recall Interaction

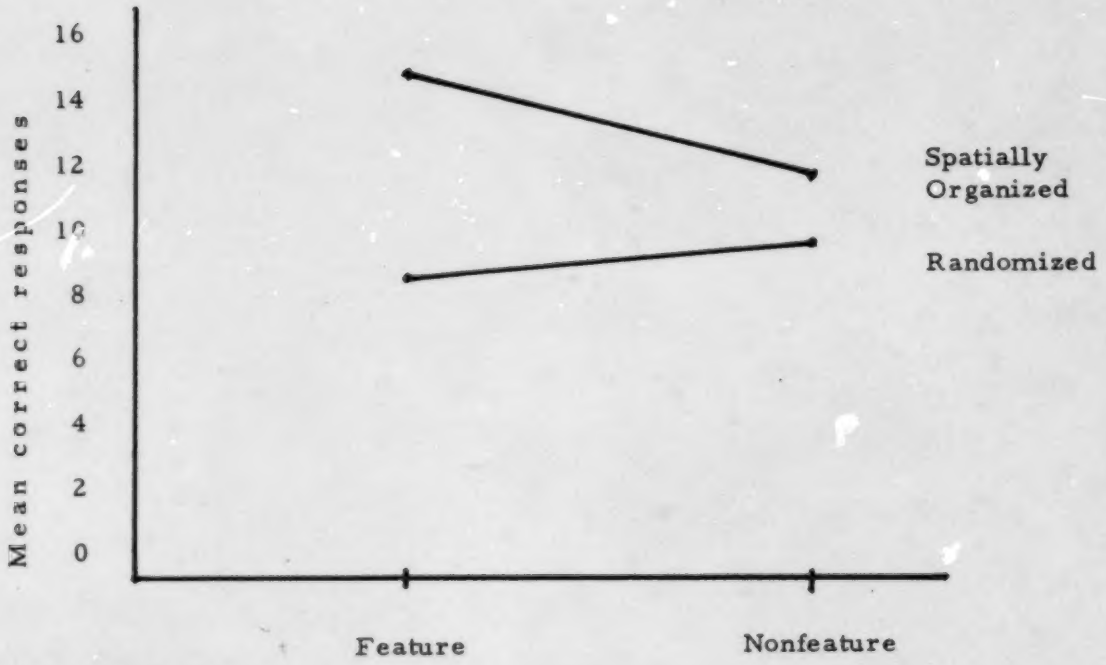


Figure 2

Experiment 1

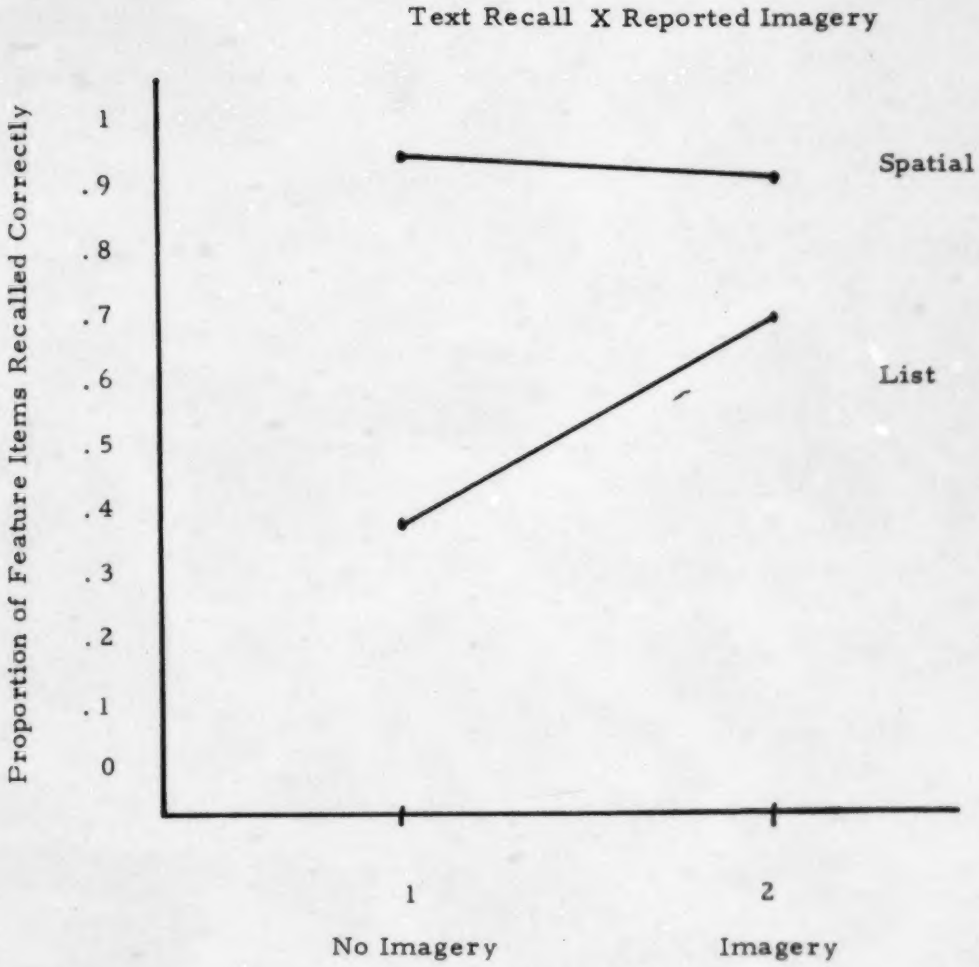
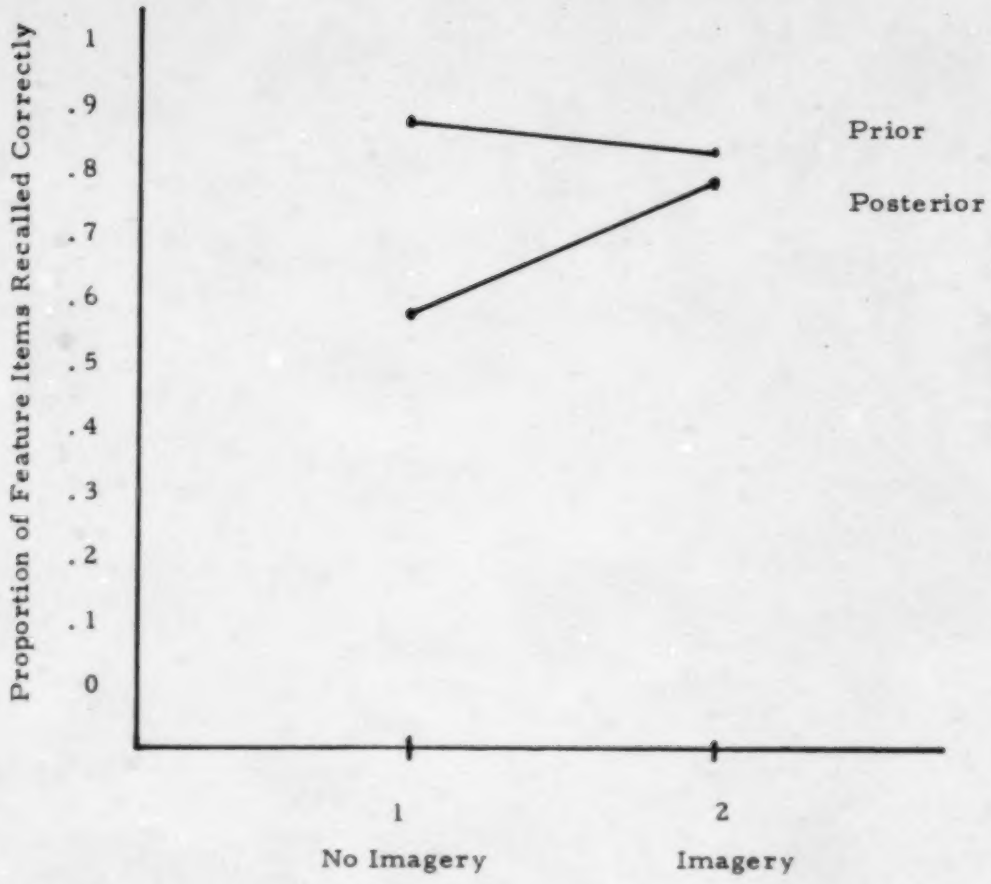


Figure 3

Experiment 2

Text Recall X Reported Imagery



Footnote

1 Thanks to Dr. Raymond W Kulhavy, of The Educational Psychology Department at Arizona State University, who provided an invaluable amount of assistance during the initial planning and preparation stages of this investigation.